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ABSTRACT

This document explains the Arkansas science benchmarks for grades 5-8 which were developed to provide guidance to science teachers. The content standards for three strands--physical science systems, life science systems, and Earth science/space science systems--were identified based on grade levels. (YDS)

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Science Grades 5 - 8 Benchmarks

Science at grades 5-6 should be taught each day, and, wherever possible, integrated into other subjects. Most Arkansas schools teach a general/integrated science at grades 5-6. Some schools use science kits. Others use the unit approach. All are acceptable.

Most Arkansas schools teach life science at the 7th grade and earth science at the 8th grade. Some schools are teaching an integrated science at grades 7-8 and 7-9. Please note that the physical system benchmarks are the same in both the 7th and 8th grades. The same is true for the life and earth systems benchmarks.

If your school is teaching life science in the 7th grade, cover the benchmarks for life science in the 7th grade only. If your school is teaching earth science in the 8th grade, cover the benchmarks for science in the 8th grade only. If your school is teaching an integrated science in the 7th and 8th grades, you will need to cover a mix of life, earth, and physical science benchmarks.

When a benchmark exam is developed for the 8th grade in science, schools will be informed well in advance as to what to expect on the exam. Adjustments can be made at that time.

These benchmarks are guides and not absolutes. The teachers in each district should develop the district's own scope and sequence in grades K-12 by vertical alignment of the curriculum. Each teacher should know what is taught in preceding as well as following grades.

Neither the science framework nor this benchmark will follow the sequence of any textbook. Neither the framework nor this benchmark will cover all the possible science topics. Schools should decide what additional topics to cover to best prepare their students.

Science should be taught by activity (labs, inquiry activities, experiments with adequate lab equipment, projects, problem-solving, etc.) with less emphasis on lecture and answering the questions at the end of the chapter.

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STRAND 1: PHYSICAL SYSTEMS
CONTENT STANDARD 1
Students will demonstrate an understanding of physical systems as a process of inquiry.

Learner Expectations	Grade Five	Grade Six	Grade Seven	Grade Eight
PS.1.1. Understand that the laws of science are universal.	Students understand that physical phenomena behave the same everywhere on Earth.	Students understand that physical phenomena behave the same on other planets as they do on Earth. Students can distinguish between a hypothesis and a scientific theory.	Students understand that natural events occur in patterns that are usually predictable. Students can use the science terms hypothesis, theory, and law in discussing how scientists develop their concepts.	Students can explain how the Earth/moon system is affected by gravity. Students understand that a scientific theory is a well-substantiated explanation of some aspect of how the natural world works. The theory explains facts, laws, inferences, and tested hypotheses.
PS.1.2. Understand that a scientific theory is based on current, accepted evidence and is used to make predictions.	Students understand that scientific theories provide explanations of how the world works. Students understand that scientists look at the natural world and develop a hypothesis about how something works and then test the hypothesis many times.	Students understand that scientific theories can be used to predict future physical events. Students understand that before ideas (hypotheses or theories) are accepted by other scientists, the ideas are reviewed and tested many times.	Students can recognize that science theories fulfill the following requirements: (1) the theory can explain what has been observed, (2) the theory can predict that which has not yet been observed, (3) the theory can be tested by further experimentation and be modified as new data are acquired.	Students can recognize that science theories fulfill the following requirements: (1) the theory can explain what has been observed, (2) the theory can predict that which has not yet been observed, (3) the theory can be tested by further experimentation and be modified as new data are acquired.
PS.1.3. Generate written conclusions based on evidence acquired through experimentation.	Students conduct experiments and write lab reports.	Students reach independent conclusions about experiments. Individual conclusions are compared and reviewed in class.	Students can write conclusions based on experimental or observational data collected from research.	Students can write conclusions based on experimental or observational data collected from research.
PS.1.4. Interpret scientific information from graphs and charts.	Students interpret graphs and charts.	Students form interpretations based on information in graphs and charts.	Students can interpret scientific information from graphs or charts.	Students can interpret scientific information from graphs or charts.

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STRAND 1: PHYSICAL SYSTEMS
CONTENT STANDARD 2
Students will explore, demonstrate, communicate, apply, and evaluate the knowledge of physical systems.

Learner Expectations	Grade Five	Grade Six	Grade Seven	Grade Eight
PS.2.1. Demonstrate an understanding of the *states of matter* and describe the various combinations of matter (*mixtures* and *compounds*).	Students can name and compare the states of matter (solid, liquid, and gas).	Students can describe and classify matter in terms of elements, compounds, and mixtures.	Students can identify the states of matter. Students can identify mixtures and compounds in classroom activities.	Students can identify the states of matter. Students can identify mixtures and compounds in classroom activities.
PS.2.2. Identify and describe the properties of an atom.	Students should be able to name and identify characteristics of electrons, protons, and neutrons.	Students should be able to identify where in atom electrons, protons, and neutrons are found. Students understand that atoms can combine to form molecules with properties different from the atoms'.	Students can name the parts of an atom and identify the charges of each part. Students can describe the current model of an atom and give the locations of the parts of the atom. Students can describe the mass number and atomic number of common elements. Students can describe radioactivity and its uses and dangers.	Students can name the parts of an atom and identify the charges of each part. Students can describe the current model of an atom and give the locations of the parts of the atom. Students can describe the mass number and atomic number of common elements. Students can describe radioactivity and its uses and dangers.
PS.2.3. Investigate the *periodic chart*.	Students can name and write the symbol for several common elements.	Students know that elements are grouped by like characteristics. Students should be able to find common elements on a periodic chart.	Students can explain in general terms the organization of the Periodic Table. Students can name and give the properties of common elements. Students can identify the properties of metals and non-metals.	Students can explain in general terms the organization of the Periodic Table. Students can name and give the properties of common elements. Students can identify the properties of metals and non-metals.

Learner Expectations	Grade Five	Grade Six	Grade Seven	Grade Eight
PS.2.4. Experiment and identify *physical* and *chemical changes*.	Students can identify common examples of physical and chemical changes.	Students (given materials) can set up and conduct an experiment that shows a physical change or a chemical change. Students should be able to describe and give examples of how elements can combine to form new substances which often have different properties.	Students (given materials) can set up and conduct an experiment that shows a physical change or a chemical change.	Students (given materials) can set up and conduct an experiment that shows a physical change or a chemical change.
PS.2.5. Examine the sources and analyze the preservation of energy resources.	Students research print and nonprint resources and write about energy resources and ways to preserve limited energy resources..	Students research print and nonprint resources for ways to preserve limited energy resources.	Students research the sources of energy used by man (coal, natural gas, petroleum, solar, and nuclear) and develop ways of conserving this energy and developing alternative energy sources.	Students research the sources of energy used by man (coal, natural gas, petroleum, solar, and nuclear) and develop ways of conserving this energy and developing alternative energy sources.
PS.2.6. Experiment with *forces* (*gravity*, *magnetism*, and *electricity*).	Students can perform experiments dealing with the force of gravity (free-fall, down a ramp, or stairs). Students know that objects do not change direction unless acted upon by an outside force.	Students can set up examples of forces in magnets and electricity (using magnets, small batteries, wire, and a magnetic compass. No AC current).	Students can set up demonstrations of gravity, magnetism, and electricity to show how they act on different objects. Students can set up simple, series, and parallel electrical circuits.	Students can set up demonstrations of gravity, magnetism, and electricity to show how they act on different objects. Students can set up simple, series, and parallel electrical circuits.
PS.2.7. Investigate the laws of motion.	Students understand how inertia, gravity, friction, mass, and force affect motion.	Students can give examples of inertia, gravity, friction, mass, and force in everyday life.	Students can set up demonstrations that show inertia, gravity, friction, and mass. Students can state the laws of motion.	Students can explain how the Earth- Moon system is affected by gravity.

Learner Expectations	Grade Five	Grade Six	Grade Seven	Grade Eight
PS.2.8. Demonstrate and communicate the relationship between magnetic fields and electric currents.	Students can experiment with a compass near electrical appliances.	Students can set up examples of forces in magnets and electricity (using magnets, small batteries, wire, and a magnetic compass. No AC current).	Students demonstrate an understanding of a simple circuit. Students demonstrate an understanding of the difference between a generator and a motor.	Students demonstrate an understanding of a simple circuit. Students demonstrate an understanding of the difference between a generator and a motor. Students can identify parts of a manufactured electric motor.
PS.2.9. Introduce the *electromagnetic spectrum* (radio, infrared, visible light, and ultraviolet *waves*, x-rays).	Students experiment with the spectrum of light passing through a prism. Students describe the results of light passing through lenses of different shapes.	Students describe the results of light passing through a small slit when shown upon a screen. Students can name some of the invisible parts of the electromagnetic spectrum.	Students can describe radio, infrared, visible light, ultraviolet waves, and x-rays and their properties. Students can describe the speed of light and how light reacts when it passes through a prism and through different lenses. Students can describe the wave nature of electromagnetic spectrum (wavelength, frequency, speed, interference, and diffraction, etc.).	Students can describe radio, infrared, visible light, ultraviolet waves, and x-rays and their properties. Students can describe the speed of light and how light reacts when it passes through a prism and through different lenses. Students can describe the wave nature of electromagnetic spectrum (wavelength, frequency, speed, interference, and diffraction, etc.).

Learner Expectations	Grade Five	Grade Six	Grade Seven	Grade Eight
PS.2.10. Investigate and identify conductors and insulators of heat and electricity.	Students can name objects that are conductors of heat and objects that are insulators of heat.	Students can name objects that are conductors of electricity and objects that are insulators of electricity.	Students understand that the heat of an object is total kinetic energy of the random motion of atoms and molecules. Students can name objects that are conductors of heat and objects that are insulators of heat. Students can name objects that are conductors of electricity and objects that are insulators of electricity.	Students understand that the heat of an object is total kinetic energy of the random motion of atoms and molecules. Students can name objects that are conductors of heat and objects that are insulators of heat. Students can name objects that are conductors of electricity and objects that are insulators of electricity.
PS.2.11. Distinguish energy transfer (*conduction, convection, and radiation*).	Students demonstrate an understanding of conduction of heat.	Students can model examples of convection and radiation of heat.	Students can describe and give examples of the three ways energy is transferred.	Students can describe and give examples of the three ways energy is transferred.
PS.2.12. Investigate sound *waves* and gamma rays.	Students can explain how sound waves travel through water.	Students can experiment with sound waves.	Students can describe the wave nature of sound (wavelength, frequency, speed, interference, and diffraction, etc.). Students describe the benefits and hazards of gamma rays.	Students can describe the wave nature of sound (wavelength, frequency, speed, interference, and diffraction, etc.). Students describe the benefits and hazards of gamma rays.

STRAND 1: PHYSICAL SYSTEMS
CONTENT STANDARD 3
Students will demonstrate an understanding of the connections and applications of physical science.

Learner Expectations	Grade Five	Grade Six	Grade Seven	Grade Eight
PS.3.1. Design and conduct different kinds of scientific investigations to answer different kinds of questions.	Students design and conduct experiments.	Students design and conduct experiments.	Students design experiments to test the sound levels in their environment.	Students design experiments to test an environmental issue in their community.

PS.3.2. Demonstrate how physical science is connected to mathematics (analyze collected data).	Students are aware of the mathematical need to collect more than one set of data in conducting experiments.	Students conduct several trials of data and average the data.	Students can use mathematical formulas to solve problems.	Students can use mathematical formulas to solve problems.

Learner Expectations	Grade Five	Grade Six	Grade Seven	Grade Eight
PS.3.3. Apply multiple strategies to problem solving.	Students research the library and the Internet to find several answers to solve a problem and then determine the most scientifically sound solution.	Students develop strategies to solve problems and compare answers with other students.	Students can apply brainstorming techniques in problem solving.	Students can apply brainstorming techniques in problem solving.
PS.3.4. Use appropriate equipment, tools, techniques, technology, mathematics, and technical writing in scientific investigation.	Students are aware of and practice safety rules and can identify these rules on exams. Students can use glassware, batteries, electrical connections, magnifiers, magnets, light bulbs, chemicals, Genecons, compasses, etc. as part of physical science experiments and can write about their investigations.	Students are aware of and practice safety rules and can identify these rules on exams. Students can use glassware, batteries, electrical connections, magnifiers, magnets, light bulbs, chemicals, Genecons, compasses, etc. as part of physical science experiments and can write about their investigations.	Students are aware of and practice safety rules and can identify these rules on exams.	Students are aware of and practice safety rules and can identify these rules on exams.
PS.3.5. Investigate a variety of careers related to physical science.	Students can identify knowledge an astronaut would need for his/her job.	Students can Identify life science professions.	Students can identify careers in the physical sciences.	Students research careers in the physical sciences, such as chemist, physicist, astronomer, geologist, engineer, etc.
PS.3.6. Acknowledge the impact of scientific discoveries upon society.	Students discuss the impact of scientific discoveries on their lives.	Students can discuss the impact of space exploration on society.	Students can identify men and women of science, cite their discoveries, and discuss their effects on society.	Students can identify men and women of science, cite their discoveries, and discuss their effects on society.
PS.3.7. Recognize that scientific discovery has been influenced by historical events.	Students can identify historical events surrounding the development of communication systems.	Students can identify events surrounding the development of transportation systems.	Students can link important scientific discoveries to historical events and show how they are related.	Students can link important scientific discoveries to historical events and show how they are related.

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STRAND 2: LIFE SCIENCE SYSTEMS
CONTENT STANDARD 1
Students will demonstrate an understanding of life science as a process of inquiry.

Learner Expectations	Grade Five	Grade Six	Grade Seven	Grade Eight
LS.1.1. Recognize that science deals only with inquiry about the natural world.	Students understand the domain of science in the natural world. Students can name questions that science cannot answer.	Students are able to distinguish between science and non-science concepts and questions.	Student can recognize that science theories fulfill the following requirements: (1) the theory can explain what has been observed, (2) the theory can predict that which has not yet been observed, (3) the theory can be tested by further experimentation and be modified as new data are acquired.	Student can recognize that science theories fulfill the following requirements: (1) the theory can explain what has been observed, (2) the theory can predict that which has not yet been observed, (3) the theory can be tested by further experimentation and be modified as new data are acquired.
LS.1.2. Interpret scientific information from graphs and charts.	Students interpret graphs and charts.	Students form individual interpretations about graphs and charts. These interpretations are then compared and reviewed in class.	Students can interpret scientific information based on graphs or charts.	Students can interpret scientific information taken from graphs or charts.
LS.1.3. Conduct investigative science through use of the *scientific method*	Students can set-up experiments or observati ons based on the scientific method.	Students can set-up experiments or observations based on the scientific method.	Students can set up an experiment.	Students can set up an experiment.
LS.1.4. Generate conclusions based on evidence acquired through experimentation.	Students draw conclusions based on experimental results.	Students (as individuals) can form conclusions based on experimental results in LS.1.3. above.	Students (as individuals) can form conclusions based on experimental results in LS.1.3. above.	Students (as individuals) can form conclusions based on experimental results in LS.1.3. above.

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STRAND 2: LIFE SCIENCE SYSTEMS CONTENT STANDARD 2 Students will explore, demonstrate, communicate, apply and evaluate the knowledge of life systems.				
Learner Expectations	Grade Five	Grade Six	Grade Seven	Grade Eight
LS.2.1. Identify, describe, and explain various types of cells and cell processes.	Students can identify and name the functions of the parts of plant or animal cells.	Students understand the importance of oxygen to living things. Students understand the importance of water, minerals, fats, proteins, and carbohydrates to living things.	Students can identify and name the function of the cell membrane, nucleus, organelles, RNA, and DNA. Students can describe diffusion, osmosis, and cell transport.	Students can identify and name the function of the cell membrane, nucleus, organelles, RNA, and DNA. Students can describe diffusion, osmosis, and cell transport.
LS.2.2. Describe similarities and differences between single celled and multicellular organisms.	Students can recognize single-celled organisms under a microscope.	Students can recognize cells in tissues under a microscope.	Students can describe similarities and differences between single-celled and multicellular organisms.	Students can describe similarities and differences between single-celled and multicellular organisms.
LS.2.3. Arrange organisms into groups according to similarities and differences.	Students can identify vertebrates and invertebrates (chordates and non-chordates).	Students can identify examples of Arkansas seed plants, mollusks, arthropods, fish, amphibians, and mammals. Students can arrange examples of bacteria, fungi, and plants into their correct groups.	Students will identify various common living things (e.g., bacteria, protists, fungi, plants, sponges, cnidarians, flatworms, roundworms, mollusks, segmented worms, arthropods, echinoderms, fish, amphibians, reptiles, birds, mammals, etc.) and name their characteristics. Students understand why we have biodiversity.	Students will identify various common living things (e.g., bacteria, protists, fungi, plants, sponges, cnidarians, flatworms, roundworms, mollusks, segmented worms, arthropods, echinoderms, fish, amphibians, reptiles, birds, mammals, etc.) and name their characteristics. Students understand why we have biodiversity.
LS.2.4. Identify the requirements for living organisms.	Students can identify air, water, food, space, and shelter as important to living things.	Students can explain why animals need space and shelter to thrive.	Students identify the requirements of living things.	Students identify the requirements of living things.
LS.2.5. Explain life cycles of various organisms.	Students can explain the life cycle of plants and animals.	Students can explain the life cycle of specific.	Students can explain the life cycles of plants and animals, e.g., insects, amphibians, reptiles, birds, mammals, ferns, and seed plants.	Students can explain the life cycles of plants and animals, e.g., insects, amphibians, reptiles, birds, mammals, ferns, and seed plants.

Learner Expectations	Grade Five	Grade Six	Grade Seven	Grade Eight
LS.2.6. Describe the parts of the human body systems and determine their function.	Students can locate human body organs in pictures or models. Students can name the function of the brain, heart, kidneys, lungs, bones, and skin.	Students can describe the route oxygen travels from the nose to the body cells where it is converted to energy. Students can describe and trace the route food takes until it leaves the body. Students can describe neural paths.	Students will name the parts of each body system and describe its function. Students will describe common human diseases, their causes and treatments. Students will describe the differences in viral and bacterial diseases that affect these systems.	Students will name the parts of each body system and describe its function. Students will describe common human diseases, their causes and treatments. Students will describe the differences in viral and bacterial diseases that affect these systems.
LS.2.7. Describe how heredity and environment influence/determine characteristics of an *organism*.	Students know that offspring inherit traits from their parents. Students know that these traits reside in the nucleus of cells.	Students can describe how genes produce traits. Students give examples of animal offspring learning from their parents.	Students can describe how genes produce traits and how these traits are passed to offspring (dominant, recessive, probability of passage to offspring, mutations, etc.). Students can describe the effect of environment on offspring as it develops (foods, learning experiences, and parental support).	Students can describe how genes produce traits and how these traits are passed to offspring (dominant, recessive, probability of passage to offspring, mutations, etc.). Students can describe the effect of environment on offspring as it develops (foods, learning experiences, and parental support).
LS.2.8. Recognize that reproduction is a characteristic of all living *organisms* and is essential to the continuation of life.	Students can describe the fertilization and seed development in common plants.	Students can describe fertilization and development in animals.	Students can describe fertilization, development, and growth in plants and animals.	Students can describe fertilization, development, and growth in plants and animals.

LS.2.9. Explain how physical and/or behavioral characteristics of *organisms* help them to adapt and survive in their environments	Students can describe what physical and behavioral characteristics animals have that allow them to survive seasonal changes.	Students can describe what physical and behavioral characteristics plants have that allow them to survive seasonal changes.	Students can describe how physical adaptations of plants and animals help them to survive in their environment. Students can identify how behavioral characteristics in animals and humans help them to survive in their environments.	Students can describe how physical adaptations of plants and animals help them to survive in their environment. Students can identify how behavioral characteristics in animals and humans help them to survive in their environments.
Learner Expectations	Grade Five	Grade Six	Grade Seven	Grade Eight
LS.2.10. Describe how genetic material changes through time producing new species while some older species die out and become extinct.	Students understand that the Earth is quite old and that life began about 3.5 billion years ago and has changed over time (evolved). Students understand that there have been organisms (fern trees, dinosaurs, mammoths, etc.) that no longer exist today.	Students understand that over long periods of time the genes in a population of organisms change because of the changes in the DNA. Students understand that there have been large extinctions caused by planetary impacts, climate changes, food sources depletion, and loss of habitat, and that these provided different environments.	Students understand that life on Earth began 3.5 billion years ago and that there have been several large extinctions, but life has evolved since that time. Students understand that all living things are related to one another through common ancestry from earlier forms that differed from the present forms. Students understand the mechanisms of evolution (e.g., gene mutation, natural selection, and changes in the environment).	Students understand that life on Earth began 3.5 billion years ago and that there have been several large extinctions, but life has evolved since that time. Students understand that all living things are related to one another through common ancestry from earlier forms that differed from the present forms. Students understand the mechanisms of evolution (e.g., gene mutation, natural selection, and changes in the environment).
LS.2.11. Analyze ecosystems in terms of population relationships, *food webs*, energy flow, and *biotic succession*.	Students can identify food webs, energy flow, and succession in an environment.	Students can identify food webs, energy flow, and succession in an environment.	Students can identify biotic and abiotic factors, changes in populations, and limiting factors, habitats, niches, and flow of energy in ecosystems. Students can identify various communities and biomes and the succession within these.	Students can identify biotic and abiotic factors, changes in populations, and limiting factors, habitats, niches, and flow of energy in ecosystems. Students can identify various communities and biomes and the succession within these.

LS.2.12. Evaluate human impact on the environment.	Students can evaluate the impact of their community activity on the environment.	Students can evaluate the impact of their community's activities on the environment.	Students can name the natural resources used by humans. Students can name examples of wise and unwise use of natural resources.	Students can name the natural resources used by humans. Students can provide examples of wise and unwise use of natural resources.

STRAND 2: LIFE SCIENCE SYSTEMS
CONTENT STANDARD 3
Students will demonstrate an understanding of the connections and applications in life sciences

Learner Expectations	Grade Five	Grade Six	Grade Seven	Grade Eight
LS.3.1. Design and conduct life science investigations to answer different kinds of questions.	Students design an investigation to solve a problem at their school.	Students design an investigation to solve a problem in their community.	Students identify questions about life that science can and cannot answer in the future.	Students identify questions about life that science can and cannot answer in the future.
LS.3.2. Correlate life science activities to other curricular areas (e.g., language arts, mathematics, social studies).	Students name when art, music, math, language arts, health and physical education skills are important to science activities.	Students write clearly about science. Students write about the importance of mathematics to scientific research. Students write about the importance of events of history in shaping scientific discoveries.	Students can identify life science discoveries that have had an impact on society in the last 10 years. Students can identify the importance of shapes and colors to the life sciences. Students understand the importance of probability to genetics and mathematics to scientific problem solving.	Students can identify life science discoveries that have had an impact on society in the last 10 years. Students can identify the importance of shapes and colors to the life sciences. Students understand the importance of probability to genetics and mathematics to scientific problem solving.
LS.3.3. Apply multiple strategies to problem solving.	Students can research various print and nonprint resources to find solutions for scientific problems.	Students develop multiple strategies to solve problems.	Students can apply brainstorming techniques in problem solving.	Students can apply brainstorming techniques in problem solving.

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LS.3.4. Use appropriate equipment, tools, techniques, technology, mathematics, and technical writing in scientific investigation.	Students are aware of safety rules and can identify these rules on exams.	Students are aware of safety rules and can identify these rules on exams.	Students are aware of safety rules and can identify these rules on exams and in practice. Students can use microscopes, water and soil test kits, dissection kits, medical test kits, aquariums, habitats, computers, etc.	Students are aware of safety rules and can identify these rules on exams and in practice. Students can use microscopes, water and soil test kits, dissection kits, medical test kits, aquariums, habitats, computers, etc.
LS.3.5. Investigate a variety of careers related to life sciences.	Students can identify life science knowledge in careers found in the local community.	Students can describe what botanists, zoologists, and microbiologists do for work.	Students can identify careers in the biology sciences.	Students can identify careers in biology: biologist, botanist, bacteriologist, zoologist, ecologist, geneticist, horticulturist, ichthyologist, microbiologist, etc.

STRAND 3: EARTH/SPACE SYSTEMS

CONTENT STANDARD 1

Students will demonstrate an understanding of the inquiry process through the study of earth and space systems.

Learner Expectations	Grade Five	Grade Six	Grade Seven	Grade Eight
ES.1.1. Identify the components of Earth (rocks, water, and air) and their properties.	Students can identify the layers of the atmosphere.	Students can identify the layers of Earth.	Students can identify rocks, water, layers of the Earth and atmosphere from models or posters.	Students can identify rocks, water, layers of the Earth and atmosphere from models or posters.
ES.1.2. Understand that Earth and objects in space constantly undergo changes and/or cycles that can be observed and measured.	Students explain the evolution of stars and planets in general terms.	Students can explain the Big Bang Theory in broad terms.	Students describe the Big Bang Theory and the evolution of our sun and planets.	Students describe the Big Bang Theory and the evolution of our sun and planets.
ES.1.3. Generate conclusions based on evidence acquired through experimentation.	Students draw conclusions from their experiments.	Students draw conclusions based on their experiments.	Students draw conclusions based on their experiments.	Students draw conclusions based on their experiments.
ES.1.4. Interpret scientific information from graphs and charts.	Students interpret graphs and charts.	Students form interpretations based on graphs and charts.	Students can draw interpretations about scientific information taken from graphs or charts.	Students can read and interpret earth science graphs, charts and models.

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ES.1.5. Identify and classify rocks and *minerals*.	Students can identify common sandstone, shale, and limestone rocks native to Arkansas. Students can identify some common minerals.	Students can classify rock into sedimentary, igneous, and metamorphic groupings. Students can classify minerals by hardness.	Students can identify common rocks and minerals based on characteristics such as color, streak tests, hardness, crystal shape, etc. Students can name ways that common rocks and minerals are used by people. Students can identify common rocks found in their area.	Students can identify common rocks and minerals based on characteristics such as color, streak tests, hardness, crystal shape, etc. Students can name ways that common rocks and minerals are used by people. Students can identify common rocks found in their area.
ES.1.6. Understand the relationship between Earth and objects in space.	Students demonstrate an understanding of Earth's place in the solar system.	Students demonstrate an understanding of the relationship between the Earth and objects in space.	Students understand Earth's position in our galaxy and in our solar system.	Students understand Earth's position in our galaxy and in our solar system.

STRAND 3: EARTH/SPACE SYSTEMS				
CONTENT STANDARD 2				
Students will explore, demonstrate, communicate, apply and evaluate knowledge of the properties of earth and space systems.				
Learner Expectations	Grade Five	Grade Six	Grade Seven	Grade Eight
ES.2.1. Investigate the formation and properties of rocks (*igneous, sedimentary,* and *metamorphic*), *minerals,* and *fossils*.	Students can describe the formation of igneous, metamorphic, and sedimentary rocks. Students can identify common Arkansas fossils.	Students can describe the crystal structure of common minerals and how they were formed. Students can identify common minerals.	Students research and explore the rock cycle. Students can describe the formation of minerals and fossils. Students can describe the properties of igneous, metamorphic and sedimentary rocks. Students can identify common types of igneous, metamorphic and sedimentary rocks, minerals, and fossils.	Students research and explore the rock cycle. Students can describe the formation of minerals and fossils. Students can describe the properties of igneous, metamorphic and sedimentary rocks. Students can identify common types of igneous, metamorphic and sedimentary rocks, minerals, and fossils.

ES.2.2. Understand the relationship, which exists between rock formation, fossil evidence, and geological history and age of the Earth.	Students understand the Earth's age to be 4.5 billion + years old based on the age of the rocks based on radioactive dating. Students can describe how fossils are used to compare the layers and ages of the Earth.	Students understand the age of the Earth and when living things first appeared on Earth 3.5 billion years ago.	Students can identi fy common fossils found in Arkansas. Students understand the Earth's age to be 4.5 billion + years old based on the age of the rocks determined by radioactive dating. Students understand that life on Earth began 3.5 billion years ago and that there have been several large extinctions, but life has evolved since that time.	Students can identify common fossils found in Arkansas. Students understand the Earth's age to be 4.5 billion + years old based on the age of the rocks determined by radioactive dating. Students understand that life on Earth began 3.5 billion years ago and that there have been several large extinctions, but life has evolved since that time.

Learner Expectations	Grade Five	Grade Six	Grade Seven	Grade Eight
ES.2.3. Investigate how Earth's internal processes affect external features (volcanoes, earthquakes, and mountain formation).	Students can identify layers of the Earth's core and their properties. Students can identify various landforms.	Students can explain the processes related to the formation of mountains, earthquakes, and volcanoes.	Students can describe plate tectonics and evidence for continental drift. Students can read topographic maps.	Students can describe plate tectonics and evidence for continental drift. Students can read topographic maps.

ES.2.4. Understand the effects of *weathering* and *erosion* on the Earth's surface.	Students can describe how soil is formed and how it erodes. Students can describe how wind, water, and ice erode rocks and soil.	Students can explain the process of erosion.	Students can describe how rocks are weathered. Students can describe how soil is formed. Students can identify soil types found in their area. Students can identify and give examples of local erosions and depositions.	Students can describe how rocks are weathered. Students can describe how soil is formed. Students can identify soil types found in their area. Students can identify and give examples of local erosions and depositions.
ES.2.5. Describe and model the natural divisions of Arkansas.	Students can identify the geologic features and plant communities of the six natural divisions of Arkansas.	Students can name the land uses and history in each of the six natural divisions of Arkansas.	Students can describe the characteristics and components of each of the natural divisions in Arkansas. Students understand why we have biodiversity in the natural divisions.	Students can describe the characteristics and components of each of the natural divisions in Arkansas. Students understand why we have biodiversity in the natural divisions.
ES.2.6. Describe the energy transfer within the *atmosphere* as it relates to the development of weather and climate patterns.	Students can describe how sun heats the atmosphere and produces our winds. Students can describe how the sun heats the atmosphere and drives the water cycle.	Students can describe how the energy transfer within the atmosphere produces our weather and climate.	Students can describe the properties of air and the layers of the atmosphere. Students can describe how the Sun drives our climate, seasons, and weather changes.	Students can describe the properties of air and the layers of the atmosphere. Students can describe how the Sun drives our climate, seasons, and weather changes.

Learner Expectations	Grade Five	Grade Six	Grade Seven	Grade Eight
ES.2.7. Explain and illustrate the *water cycle*.	Students can identify the components in the water cycle (evaporation, condensation, and precipitation) from models or drawings.	Students demonstrate with a model the water cycle by using a heat source to drive the process.	Students can relate the water cycle to weathering and erosion.	Students can relate the water cycle to weathering and erosion. Students can construct a water cycle model.
ES.2.8. Model and explain how the Earth's shape and tilt result in different seasons.	Students can describe how the tilt of the Earth produces our seasons.	Students can describe what produces the different seasons on Earth (tilt of the Earth).	Students can set up a model to explain the different seasons on Earth.	Students can set up a model to explain the different seasons on Earth.
ES.2.9. Investigate the predictable motion of objects in space in explaining phenomena such as day, night, moon phases, ocean tides, and eclipses.	Students can design models to show the rotation and revolution of the Earth. Students can also model one Earth day in relationship to the sun.	Students can design a model to illustrate what causes tides on Earth. Students can design a model to illustrate what causes lunar eclipses.	Students can explain rotation, revolution of the Earth, the moon and the sun and the relationship each has to the other (day, night, moon phases, tides, and eclipses).	Students set up models to explain rotation, revolution of the Earth, moon and the sun and the relationship each has to the other (day, night, moon phases, tides, and eclipses).
ES.2.10. Analyze how the features of the oceans affect humans.	Students can describe the features of the ocean.	Students can describe how man has depended upon the ocean for resources.	Students can describe human uses of the ocean for travel, food production (estuaries), exploration, energy, and mineral sources. Students can describe ocean features, landforms, and pressure and how these have affected exploration of the marine frontier.	Students can describe human uses of the ocean for travel, food production (estuaries), exploration, energy, and mineral sources. Students can describe ocean features, landforms, and pressure and how these have affected exploration of the marine frontier.

Learner Expectations	Grade Five	Grade Six	Grade Seven	Grade Eight
ES.2.11. Compare the ability to support life on Earth and other objects in space.	Students can compare and contrast the life supporting abilities of the Earth and our moon.	Students can compare and contrast the life supporting abilities of the Earth and the International Space Station.	Students can name conditions needed for life as we know it on Earth and can compare these with conditions we think exist on other planets and moons. Students can describe man's attempts at monitoring life in outer space, e.g., the International Space Station.	Students can name conditions needed for life as we know it on Earth and can compare these with conditions we think exist on other planets and moons. Students can describe man's attempts at monitoring life in outer space, e.g., the International Space Station.
ES.2.12. Explain and compare the properties (*gravity*, size, shape, distance, and color) of objects in the *solar system*.	Students can name and describe objects in our solar system.	Students can describe the formation of our solar system. Students can describe the characteristics of objects in our solar system.	Students can compare and contrast our sun, planets, moons, meteors, comets and other objects (size, shape, color, distance and gravity). Students can describe the evolution of the universe.	Students can compare and contrast our sun, planets, moons, meteors, comets and other objects (size, shape, color, distance and gravity). Students can describe the evolution of the universe.
ES.2.13. Explore past, present, and future space technology.	Students can describe the history of space exploration from the first satellites to the present.	Students can describe the present and future efforts of NASA.	Students can depict a history of developments in space programs.	Students can depict a history of developments in space programs.
ES.2.14. Relate the physical characteristics of the sun to other stars.	Students can compare our sun to other stars.	Students can compare the life cycle of our sun to other stars.	Students can compare and contrast our sun to other well-known stars. Students can compare our sun's evolution to that of other stars.	Students can compare and contrast our sun to other well-known stars. Students can compare our sun's evolution to that of other stars.

STRAND 3: EARTH/SPACE SYSTEMS
CONTENT STANDARD 3
Students will demonstrate an understanding of the connections and applications of earth /space systems.

Learner Expectations	Grade Five	Grade Six	Grade Seven	Grade Eight
ES.3.1. Design and conduct scientific investigations to answer different kinds of questions.	Students can design and conduct a scientific experiment.	Students can design and conduct a scientific experiment.	Students can design and conduct a scientific experiment.	Students can design and conduct a scientific experiment.
ES.3.2. Apply multiple strategies to problem solving.	Students can research various print and nonprint resources to find solutions for scientific problems.	Students develop multiple strategies to solve problems.	Students can apply brainstorming techniques in problem solving.	Students can apply brainstorming techniques in problem solving.
ES.3.3. Use appropriate equipment, tools, techniques, technology, mathematics, and technical writing in scientific investigations.	Students are aware of and practice safety rules and can identify these rules on exams.	Students are aware of and practice safety rules and can identify these rules on exams.	Students are aware of and practice safety rules and can identify these rules on exams.	Students are aware of and practice safety rules and can identify these rules on exams. Students can use telescopes, soil and water test kits, rock and mineral test kits, weather charts, thermometers, barometers, hygrometers, psychrometers, wind speed and direction indicators, and earth science computer programs.
ES.3.4. Investigate a variety of earth science related careers.	Students research careers in soil science and geology.	Students research careers in astronomy and space flight.	Students research careers in the earth sciences.	Students research careers in the earth sciences.
ES.3.5. Construct models of earth science systems and make real world applications.	Students build models to illustrate the effects of erosion on different slopes and vegetation.	Students build models to show how different building material and structures are affected by earthquakes.	Students construct models of the earth and explain how they function.	Students construct models of the earth and explain how they function.

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Learner Expectations	Grade Five	Grade Six	Grade Seven	Grade Eight
ES.3.6. Analyze the impact of human activities on the Earth's *crust, hydrosphere, atmosphere,* and *biosphere* (e.g., climate change, *greenhouse effect,* global warming, ozone depletion, and *UV radiation*) and demonstrate methods of conservation and recycling of the Earth's resources.	Students can analyze the impact of human activities on the Earth.	Students can name and describe man's activities that pollute the Earth. Students can name conservation activities that would help the environment.	Students can give the causes of global climate changes through time, greenhouse effect, global warming, ozone depletion and increased UV radiation and how to improve or prevent some of the more damaging problems. Students can demonstrate conservation and recycling at the school and home level. Students can name ways that the nation can conserve and recycle.	Students can give the causes of global climate changes through time, greenhouse effect, global warming, ozone depletion and increased UV radiation and how to improve or prevent some of the more damaging problems. Students can demonstrate conservation and recycling at the school and home level. Students can name ways that the nation can conserve and recycle.
ES.3.7. Explore the impact of space technology on society.	Students can identify space technology that has benefited people on Earth.	Students can identify how space technology has improved communication on Earth.	Students can research and write about the benefits to humans of space technology and exploration.	Students can research and write about the benefits to humans of space technology and exploration.
ES.3.8. Illustrate the positive and negative effects of human use of natural resources on Earth.	Students can describe how man uses natural resources in a positive and negative manner.	Students can describe how man uses natural resources in a positive and negative manner.	Students can understand how people have effectively and ineffectively used natural resources on Earth.	Students can understand how people have effectively and ineffectively used natural resources on Earth.
ES.3.9. Measure weather conditions using appropriate equipment.	Students can effectively and safely use materials and equipment to measure weather conditions.	Students can use appropriate materials and equipment to predict the weather and to solve earth science problems.	Students can effectively and safely use science materials and equipment.	Students can effectively and safely use science materials asn equipment.
ES.3.10. Calculate the gravitational forces of objects in space.	Students can describe gravitation forces on objects.	Students can describe why the moon circles the Earth.	Students can calculate the gravitational forces of objects in space. Students can describe in general terms the theory of gravity.	Students can calculate the gravitational forces of objects in space. Students can describe in general terms the theory of gravity.

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